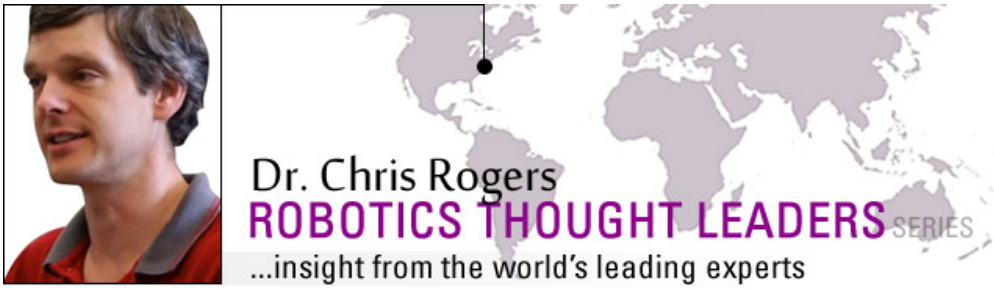
Application of LEGO-based Robotics in Higher Education: An Interview with Dr. Chris Rogers

Interview conducted by Kal Kaur



Dr. Chris Rogers, Professor, Department of Mechanical Engineering at Tufts University talks to AZoRobotics about the application of LEGO-based Robotics in Higher Education.

KK - What has been the main inspiration behind the development of LEGO-based robotics in higher education?

CR - The main inspiration comes from Papert's original thoughts about allowing students to construct their knowledge - rather than recite the knowledge of others. The LEGO toolkit allows kids to be creative, to invent, and to overcome hardships that cause them to think.

KK - How have LEGO-based robotics been introduce into the academic setting?

CR - At Tufts, we have taught introductory engineering, introductory robotics, and even image processing with the toolset.

KK - How have LEGO-based robotics changed in function and application over the past 15 years?

CR - They have switched from the classical LEGO construction to the Technic construction (with beams and pins). The software has become easier to use and the number of available sensors and actuators has increased substantially. More importantly, there is now a large community of users, sharing ideas, successful curricula and so on.

KK - What role have these learning robots played in college education over the last 15 years?

CR - They have been instrumental in exciting 15 years of first year students to start engineering from the moment they enter college. They have helped demonstrate the power of student-led learning and the importance of risk taking and failure on learning. They have also helped in getting college students to become involved with their local K-12 classrooms.

I believe that teaching is fundamentally about transferring an understanding or a story from our (teacher) heads to the heads of the students. We can do this through telling them our understanding (lecture), showing them our understanding (labs, demos, etc.), or enabling them to develop their own understanding and slowly nudge it, through argumentation, to coincide with our understanding. Good teaching is a balance of these three things - with that balance changing from student to student. I have found robotics a powerful means to get this balance with students.

KK - What age group has demonstrated the most progression in terms of end learning objects from interaction with LEGO-based robotics and why?

CR - I have no way of really measuring this progression - what you see is different learning at all levels - from the graduate student building a LEGO contraption that solves the Rubiks Cube to the 5 year old that measures the temperature of the earth with the same software and hardware.

KK - What type of student learning has been promoted in learning sciences?

CR - This is a tough question as different researchers within the learning sciences have different agendas – however, I think the one theme that is consistent throughout the literature is that all people learn differently and declaring that there is one right way to teach math, science, or any other subject is simply wrong. In fact, quite often your students will not understand the material the way you did after a certain activity.

KK - How does robotics fit with our understanding of how students learn?

CR - Robotics is a multi-disciplinary problem that requires expertise in many different subjects (from art to coding). Because of this, it allows students to appreciate and learn from the knowledge of other teammates, it promotes students to take risks, fail and iterate, and, if done well, it allows for many different viable solutions for the same problem (removing the “one right answer” approach to teaching).

KK - Can you provide a historical overview of LEGO mindstorms for education?

CR - First, the idea that a toy company should become so involved with formal education is exciting and impressive. LEGO Education started as a small division in the company and now is a stand-alone company, with a vision in how they want to see education change as well as making a profit. I have been impressed by how much they have grown since I started working with them - and more importantly how they are actively interested in changing how we educate to ensure students get a chance to be creative and innovative.

KK - What will be the next evolution of LEGO Mindstorms?

CR - I certainly have my hopes and ideas. I want to see more places for story telling through robotics, for whole classrooms to work together on one big project, for a robotic toolset that does not require any training to use.

KK - What will be the engineering challenges for students?

CR - Hopefully everything from new types of musical instruments to self-navigating cars made of LEGO bricks.

Reference

- Danahy E, Wang E, Brockman J, Carberry A, Shapiro B, and Rogers C.B. LEGO-based Robotics in Higher Education: 15 Years of Student Creativity. International Journal of Advanced Robotic Systems 2014; 11(27):1-15.

About Dr. Chris Rogers

Chris is a professor of Mechanical Engineering at Tufts University with a strong interest in engineering education. He has led research projects funded by LEGO Education, Steinway and Sons, Intel, McDonnell Douglas, NSF, NASA, Fulbright, and NIH. He has worked with LEGO Education for 15 years on the development of the LEGO Mindstorms for Schools platform and was one of the lead architects of ROBOLAB, a software environment for the LEGO RCX.

Over these 15 years, he works with teachers around the world to find more ways to enable students to drive their own learning, to fail and iterate, and to develop expertise. He has won a few awards, has flown over 700 parabolas in NASA's vomit comet without getting

sick, and was banned from kindergarten recess (as a 30 year old) for making too much noise.

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